CHAPTER 3

DESIGN CONSIDERATIONS FOR OPERATIONS AND MAINTENANCE

3-1. General design considerations

The design agency's role in the O&M concept is to establish the foundation for stable C4ISR utility systems that shall provide continuous operation incorporating redundancy (dual systems), readiness (standby systems), flexibility (multiple modes of operations), and standardization (parts and equipment). Power plant facilities, systems, and O&M documentation shall be designed to permit rapid startup and repair of equipment under emergency conditions. O&M functions shall be enhanced through the application of these guidelines by the C4ISR utility systems designer.

3-2. Historical records

A recording device shall be included in the design to provide a log of facility performance. This recorder shall accept either analog or digital signals (such as input and output parameters for generators, main switchgear feeders, uninterruptible power supply (UPS) systems, power distribution units, chillers, etc.), convert them to numerical data, scale them to useful values and store them in electronic storage. The signals should be stored at intervals of 15 minutes or other specified preset time intervals. The recorder shall have the capability to record critical signal values more frequently than the preset recording rate (for example, every five seconds) when prompted by a signal from the operator or operating equipment. The recorder shall automatically return to its primary recording when system operation returns to normal. Records shall be maintained on-site for a minimum of five years. A supervisory control and data acquisition (SCADA) system should be incorporated into the design of the systems.

3-3. Maintenance concept

The design outputs prepared by the design agency shall reflect the following maintenance concepts.

a. The design agency shall develop and implement an equipment standardization program to simplify equipment maintenance.

b. The design agency shall specify modular designed subassemblies which will permit rapid repair.

c. The design agency shall specify that manufacturers provide built-in test modules/fault sensors. Selector switches that allow personnel to access and sequentially monitor operating variables within an assembly shall be provided.

d. The design agency shall specify that a plate with an equipment tag number be attached to the equipment by the construction contractor. The design agency shall specify a method for identifying and numbering wires and cables, for marking cable termination strips, and for uniformly interconnecting equipment of different manufacturers. Corresponding identity codes shall be used for termination strips and wiring. The design agency shall specify that if a manufacturer changes the characteristics of a purchased component for use in a composite item, the true source identity of the originally purchased part will remain intact.

3-4. Evaluations

The following evaluations shall be an integral part of the design process.

a. Operations evaluations shall consider both user and system requirements.

(1) The design agency shall evaluate user requirements to determine operating philosophy and the effect that this philosophy will have on system operation, output efficiency, and personnel safety. The design agency shall determine if limits need to be placed on manual control and, if so, shall specify those limits.

(2) The design agency shall evaluate the system requirements as to the operational effects produced by changing power by switching the source of electrical power and maintenance or repair activities within the facility. The design agency shall identify equipment controls that are used during maintenance activities and provide individual controls so components can be isolated for maintenance without disrupting system operation. The design agency shall specify areas in the control system that should allow automatic adjustments to system equipment to aid the operator when events occur that demand immediate operator intervention.

b. The design agency shall evaluate user constraints and parameters to ensure maintainability of the C4ISR utility systems.

c. The design agency shall perform a hazard evaluation to ensure adherence to Occupational Safety and Health Administration (OSHA), National Electrical Code (NEC), and other locally binding safety standards.

3-5. Operations and maintenance documentation

The design agency shall perform an O&M analysis to identify the equipment in the C4ISR utility systems that contributes significantly to the maintenance burden of the system and the O&M data required to support maintenance of this equipment by the using government agency. This analysis shall be coordinated with the using government agency to determine maintenance parameters and O&M data that are available to the using government agency.

a. The design agency shall identify O&M data requirements on an individual basis for all maintenance-significant equipment. Typical data requirements include the following items.

(1) Minimum spare parts list.

(2) Recommended spare parts list.

(3) Recommended onsite test equipment.

(4) Recommended O&M training.

(5) Recommended O&M to be performed by contract.

b. The design agency shall specify functional areas of the operating system and/or equipment where a technical representative will be furnished by the manufacturer for training, test, checkout, validation, or pre-operational exercises.

c. The design agency shall specify that the construction contractor submit a schedule, listing manufacturer and vendor data that will be furnished for review and approval by the using government agency. O&M data for each equipment item shall be submitted to the using government agency prior to or at the time payment is requested for the equipment. Submission of the final data shall be completed prior to final acceptance of the facility by the using government agency.

3-6. Verification

A verification of O&M procedures and data manual content shall be performed by the using government agency to demonstrate technical accuracy, fulfillment of intent, and applicability to the performance of O&M within the facility. A review of the verification process may necessitate that additional information be obtained from the equipment manufacturer.

a. Verification should begin during the equipment acceptance process and continue as the using government agency applies the instructions, data, and technical manuals to the continuous routines of equipment operation and repair.

b. The design agency shall support the user's verification process by:

(1) Specifying acceptance test procedures which the contractor shall be expected to fulfill during facility acceptance. The format should contain adequate sign-off routines to verify the performance of equipment in accordance with design specifications.

(2) Requiring that, for specially designed equipment that does not fit well into a standard acceptance format, the contractor shall submit an acceptance plan in lieu of the designer-specified acceptance test procedures.